Remarks

Claims 1, 2, 6, and 8-37 are currently pending. The rejections to claims 1, 2, 6, and 8-37 as outlined in the Office Action of June 24, 2002 are addressed below. Claims 1, 11, and 14 have been amended to recite limitations regarding the substrate material. Claims 11 and 13 have been amended for technical clarity. These amendments are supported in the specification, at for instance, page 5, lines 15 and 16. New claim 22, reciting the limitation that the resistive elements provide a high resistance path, has been added to depend on claim 1. Support for this new claim is found in the original specification, at for instance, page 7, lines 25 to 26. Applicant submits that this amendment does not constitute new matter.

Claims 1, 3/1, 4-7, 14, 20/14, 21/14, 2, 3/2, and 9 have been rejected under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Rohrback '348. The Examiner has also rejected Claims 11 and 12 under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Schmidt. Finally, claims 10/1, 15, 20/15, 21/15, 16, 20/16, and 21/16 have been rejected under 35 U.S.C. §103(a) as unpatentable over Rohrback '771 in view of Caldecourt, and Claim 10/2 over Rohrback '771 in view of Rohrback '348 and in further view of Caldecourt.

Rohrback '771 teaches a probe that includes a corroding element and a shielded reference element for temperature compensation. Both elements are formed as metal films on a substrate. A non-conductive substrate that is rigid and resistant to chemical attack and "high" temperatures is taught at column 3, lines 18 to 20. No further teaching is provided to indicate the meaning of "high" temperature. However, none of the preferred substrate materials disclosed at column 1, lines 65 to 71 are suitable for use in a high temperature boiler or furnace environment where surface temperatures may reach 800 to 1000 °F. Applicant submits that, based on the materials disclosed therein, Rohrback could not have intended the disclosed probe to be used under such harsh and severe conditions. As such, no teaching or suggestion is provided that would direct one of skill in the art to develop a corrosion detecting device as claimed in the amended claims proposed herein.

Rohrback '348 teaches basically the same substrate materials as discussed in the '771 patent and offers no further teaching that would suggest modification of the probes described in either reference to produce the system of the present invention that is adapted for extreme high temperature applications such as in a boiler. Schmidt does not teach film elements for the

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corroding and reference electrodes at all. Rather, the use of "elements...constructed out of materials with similar temperature coefficients" is disclosed at column 1, lines 33 to 35. Schmidt also teaches a technique of compensating for temperature-related resistance effects at "room temperature" (column 5, line 25). As such, Schmidt also does not teach or provide motivation for adaptation of the Rohrback probes for use in the extreme high temperature conditions for which the present invention is suitable. Finally, Caldecourt's teaching in this regard is limited to the use of "porous paper impregnated with a resin" (column 2, lines 15-16) to serve as an insulator between the reference and corroding elements. The addition of "particulated aluminum oxide or beryllium oxide to the resin" as disclosed at column 2, lines 63 to 64 is intended merely to improve the heat conductivity of the insulating layer, not to address issues associated with extremely high temperature applications.

In response to Applicant's remarks in the amendment filed October 1, 2002, the Examiner has argued that there is no structural limitation in the claims that is not taught by the references. As noted above, Applicant proposes to amend the pending independent claims to recite the limitation that the substrate is formed of a material that is chemically inert in a fireside environment and having a high thermal conductivity. Neither the art cited by the Examiner in the pending rejections nor other art known to Applicant teaches or suggests an apparatus as claimed in claims 1, 11, or 14.

Applicant has submitted herewith two references, a conference proceeding by Farrell and Robbins and UK Patent Application No. GB 2,262,608A by Farrell, in the accompanying Supplemental Information Disclosure Statement. In regards to these references, Applicant provides the following brief comments. Farrell and Robbins (1998) teaches a system of measuring corrosion rates that is similar to that discussed in the background of the invention section at the bottom of page 2 of the originally filed specification in this matter. The disclosed system includes one or more electrodes attached to a boiler element directly or to a sacrificial element within the boiler chamber for the purpose of passing a current through the element to measure its resistance. Because the tested elements are thick – 1 mm as noted at the second to last paragraph on page 5 – relative to the rate of expected corrosion (2 nm/hr, Figure 8) and thus very conductive, a substantial current (10A, last full paragraph of page 3 or 2A, next to last paragraph on page 5) is necessary to measure the slow relative corrosion rates that occur. Temperature compensation in the sensors is achieved using software (first full paragraph on page

4). Similarly, the UK Patent application by Farrell discloses a corroding element for use in a high temperature application. The effects of varying temperature on the resistance of the corroding element are corrected for by measuring the temperature of the element and compensating the measured element resistance based on its temperature. Applicant submits that these references are not materially relevant to the patentability of the instant application.

In view of the foregoing discussion and the proposed amendments, it is respectfully submitted that this application is now in condition for allowance, and favorable consideration is requested. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned agent at the telephone number listed below. The Commissioner is hereby authorized to charge any other fees determined to be due to Deposit Account 50-2319 (Order No. A-69489/AJT/MDV).

Respectfully submitted,

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Version with Markings to Show Changes Made

In the Claims:

Amend the claims as follows. All pending claims are listed below, whether amended or not, for the Examiner's convenience.

Claim 1 has been amended as follows:

1. (Twice amended) A coupon used for measuring corrosion rates of material exposed to a hostile environment comprising:

a substrate, <u>said substrate being formed of a material that is chemically inert in a fireside environment and having a high thermal conductivity;</u>

a first long and narrow thin film resistive element carried on [such] <u>said</u> substrate and exposed to the hostile environment, and

a second long and narrow thin film resistive element carried by said substrate and shielded from the hostile environment, said first and second thin film resistive elements being positioned so that they are close enough to each other throughout their paths to experience substantially the same thermal environment, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment.

2. (Unchanged) A coupon as in claim 1 in which said thin metal elements are composed of a material which has substantially the same resistance before being subjected to a corrosive environment.

3. (Unchanged) A coupon as in claims 1 or 2 in which the substrate is an insulator.

4. (Unchanged) A coupon in as in claim 1 in which the substrate is a ceramic.

5. (Unchanged) A coupon as in claim 4 in which the ceramic is beryllium oxide.

9. (Unchanged) A coupon as in claim 2 in which said material forming the thin films is a metal or metal alloy.

10. (Unchanged) A coupon as in claims 1 or 2 in which said first and second resistive elements are on opposite sides of the substrate and the substrate is thermally thin.

Claim 11 has been amended as follows:

11. (Twice amended) A system for measuring the corrosion rate of metals in a hostile environment comprising a coupon including:

a substrate, said substrate being formed of a material that is chemically inert in a fireside environment and having a high thermal conductivity;

a [corrosive] corrodible long and narrow thin film metal resistive element carried on said substrate for exposure to the hostile environment;

a second reference long and narrow thin film metal resistive element carried on said substrate shielded from the hostile environment, said first and second thin film elements positioned on said substrate close enough to each other throughout their paths to experience substantially the same thermal environment, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment;

means for driving a current I through said first and second thin film metal elements;

means for measuring the voltage VC generated across said [corrosive] corrodible thin film metal elements and the voltage VR generated across said reference thin film element by the current flowing therethrough; and

means for processing said current and voltages to provide a measure of change in resistance of the [corrosive] corrodible thin film metal element.

12. (Unchanged) A system as in claim 11 including means for continuously receiving resistance difference to indicate the progression of corrosion.

Claim 13 has been amended as follows:

13. (Amended) A system as in claim 11 in which said thin film metal elements are deposited so as to have essentially the same resistance before corrosion of the [corrosive] corrodible element.

Claim 14 has been amended as follows:

14. (Twice amended) A coupon for use in measuring the corrosion rate of metals exposed to a high-temperature hostile environment comprising:

a substrate, <u>said substrate being formed of a material that is chemically inert in a fireside environment and having a high thermal conductivity;</u>

a first thin long and narrow elongated strip of metal or metal alloy adapted to be exposed to the hostile environment carried by said substrate; and

a second thin long and narrow elongated strip of the same metal or metal alloy as the first carried by the substrate and shielded from the hostile environment but positioned [on] close enough to said first element to experience substantially the same thermal environment as said first element, such that changes in the resistance of said first and second element as a function of temperature are identical even when said coupon is exposed to high, variable heat fluxes in said hostile environment.

15. (Unchanged) A coupon as in claim 14 in which the substrate is thin and the first and second elongated strips are on opposite faces of the substrate whereby the second elongated strip is shielded from the hostile environment by the substrate.

16. (Unchanged) A coupon as in claim 15 wherein the second elongated strip is further shielded by an oxide film on its exposed surface.

20. (Unchanged) A coupon as in any of claims 14, 15, or 16 in which the substrate is a ceramic.

21. (Unchanged) A coupon as in any of claims 14, 15, or 16, in which said substrate is a metal with an oxide insulating and protective film.

New claim 22 has been added as follows:

22. (new) A coupon as in claim 1, in which said thin film resistive elements provide a continuous high resistance path in which there is a substantial change in resistance as the electrode corrodes.